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COMPLETE SPECIFICATION

Improvements in or relating to Compositions for Furthering the Growth and Yield of Plants

We, CHEMISCHE WERKE ALBERT, a German Body Corporate of Wiesbaden-Biebrich, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention concerns new compositions for use in agriculture or horticulture particularly for regulating the growth of plants.

We have found that mono- or di- alkyl substituted ureas or cyclic substituted ureas have a growth regulating action on plants, and when used at suitable rates of application act as plant-growth stimulants. By the term "cyclic substituted ureas" as used herein we mean compounds in which the

$$-N-\overset{O}{\overset{\|}{C}}-N-$$

grouping of urea forms part of a ring system. Thus the term includes such compounds as imidazolone-2 and benzimidazolone-2.

According to the invention therefore we provide agricultural or horticultural compositions possessing plant growth regulating properties and comprising as active ingredient one or more mono-alkyl or di-alkyl substituted ureas or cyclic-substituted ureas (as herein defined) together with a suitable carrier as herein defined. The term "suitable carrier" as used herein means any substance or mixture of substances suitable for the formulation of the active ingredient for application in agriculture or horticulture, it being understood however that no claim is made herein to any previously known combination of any of the said active ingredients with any other substances.

The compositions according to the invention may be employed to regulate the growth of plants of widely differing nature. For example, at a suitable rate of application they may be used to stimulate the growth of crops of many kinds as well as to improve the development of blossom and fruit. In addition they appear to increase the resistance of plants to withering.

Valuable mono- or di-alkyl substituted ureas for use in compositions according to the invention are those in which the alkyl substituents contain from 1 to 4 carbon atoms, the *tert*-butyl group being particularly preferred. Examples of such urea derivatives are N-*tert*-butyl-urea, N,N'-di-*tert*-butyl-urea and N-N'-dimethylurea.

Of cyclic substituted ureas imidazolone-2 and derivatives thereof are particularly useful for use in compositions according to the invention. Such derivatives of imidazolone include for example alkyl-, aryl- or furyl-substituted imidazolone-2, and benzimidazolone-2, substituted, if desired, in the benzene ring by halogen, alkyl, amino, alkoxy or acyl radicals. Examples of suitable imidazolone-2 derivatives are the following compounds:—

4,5-di-[furyl]-imidazolone-2,
4,5-diphenyl-imidazolone-2,
4,5-dimethyl-imidazolone-2,
5-chloro-benzimidazolone-2,
5-methoxy-benzimidazolone-2,
5-acetyl-benzimidazolone-2,
5-myristyl-benzimidazolone-2,
5-butyryl-benzimidazolone-2,
4,5,6-trimethyl-benzimidazolone-2.

The growth-promoting action of the urea derivatives in compositions according to the invention is surprising. At the most it might have been expected that a urea derivative would have a nutritive effect equivalent to its nitrogen-content, comparable for example with urea itself.

Suitable carriers for use in the compositions according to the invention include both solid and liquid carriers. Liquid compositions according to the invention may be in the form of solutions, emulsions or suspensions, in

[*Price 3s. 6d.*]

water or suitable organic solvents of a non-phytotoxic nature. Liquid compositions may include one or more dispersing, emulsifying, suspending, wetting, nutritional, plant-growth stimulating, fungicidal, bactericidal, insecticidal, acaricidal and/or solid-improving agents.

In the preparation of emulsions containing the active urea derivatives, the urea derivatives may first be dissolved in an organic solvent, since they are generally solid at normal ambient temperatures. The solution of urea derivative may then be converted into an emulsion in water, preferably using one or more suitable emulsifying agents.

The concentration of urea derivative obtainable in an aqueous solution (which may contain other ingredients) is generally fairly low. Thus N-*tert*-butyl-urea and benzimidazolone-2 have a solubility of 0.00025% in distilled water at room temperature, and N,N'-di-*tert*-butyl-urea a solubility of 0.0003% under the same conditions. However, imidazolone-2 has a solubility of 40% under these conditions, thus permitting the preparation of highly concentrated solutions of this compound.

Solid compositions according to the invention may include various inert diluents e.g. clays, chalk, sand, earth and peat, and may take the form of dusts, granulates or wettable powders. The solid carrier may also include nutritional, other plant-growth stimulating, fungicidal, bactericidal, insecticidal, acaricidal, soil-improving agents, binding agents and also humus substances. Solid compositions according to the invention may be applied in any convenient form, for example as dusts, granulates and wettable powders etc. For the preparation of dispersions it is generally preferable to mix the urea derivative with a suitable solid carrier. The solids should of course be finely ground.

Further examples of substances which may be employed in association with urea derivatives in compositions according to the invention include for example micro-nutrients, such as the trace elements copper, manganese and boron, macro-nutrients such as superphosphate, potash and nitrogenous compounds.

The compositions according to the invention may be employed at any suitable time. Thus, for example, soil may be treated before sowing seed, the seed may itself be treated, or the growing plant may be treated at a sufficiently early period for the treatment to have a suitable effect. For treating growing plants an advantageous method of application is by spraying a liquid composition according to the invention. More than one application of a composition according to the invention during the life of a plant may, of course, be carried out.

The urea derivatives for use in compositions according to the invention are generally readily prepared. Thus, for example, benzimidazolone-2 may be prepared in good yield by reacting *o*-phenylenediamine with urea in anhydrous glacial acetic acid. By reacting urea with furoin, acetoin or benzoin, preferably in solution in acetic acid, the corresponding 4,5-disubstituted imidazolone-2 compounds may be obtained.

In order that the invention may be well understood the following Examples are given by way of illustration only.

EXAMPLE 1

Aqueous solution containing water-soluble nutrients

A Knop nutrient solution contain N-*tert*-butyl urea is made up by dissolving the following substances in 100 cc. water:—

1.00 g. calcium nitrate
0.25 g. magnesium sulphate
0.25 g. potassium dihydrogen phosphate
0.12 g. potassium chloride
0.025 g. N-*tert*-butyl urea.

To this solution is added 1cc of a 5% solution of $FeCl_3 . 5H_2O$. For application the solution is diluted with water in a ratio of nutrient solution to water of 1 to 10. The solution is suitable for so-called hydroculture.

EXAMPLE 2

Composite fertilizer solution containing macro- and micro-nutrients

A 0.1 to 0.5% aqueous solution is produced from the following mixture:—

16.4 parts by weight monoammonium phosphate
27.0 parts by weight of a mixture of ammonium sulphate and ammonium nitrate
13.0 parts by weight urea
0.4 parts by weight anhydrous magnesium sulphate
0.9 parts by weight manganese sulphate ($.1H_2O$)
0.5 parts by weight copper sulphate ($.5H_2O$)
0.1 parts by weight zinc sulphate ($.1H_2O$)
0.5 parts by weight boric acid
1.2 parts by weight N,N'-di-*tert*-butyl-urea.

This solution may be used directly, or for so-called leaf fertilizing may be diluted to a concentration of 0.1 to 0.2%.

EXAMPLE 3

Emulsion

1.66 Parts of benzimidazolone-2, 50 parts ethanol and 25 parts of cyclohexanone are heated to boiling under a reflux condenser. 5 parts olive oil and 1 part of emulsifying agent (a polyethylenealkyl ether) are gradually added. Upon dilution with water an emulsion is obtained, which can be used for spraying.

EXAMPLE 4

Dry compositions

10 parts by weight of imidazolone-2 are intimately mixed with 85 parts by weight of talc as carrier and 5 parts by weight of a dispersing agent, (a commercially available polyethylene adduct, and then finely ground. This composition is used for dusting, or alternatively

mixed with fine sand, and used for scattering. The finely ground composition may also be made up as a dispersion for spraying. Using kaolin or prepared chalk as carrier, the composition is applied as a 0.01 to 0.1% dispersion in water.

EXAMPLE 5

Seed-treating compositions

A. *Combination with insoluble, but resorbable micro-nutrients*

The following are mixed dry with 5 to 20 parts of 4,5-di-(furyl)-imidazolone-2:—

15 to 30 parts by weight calcium borate
15 to 30 parts by weight cuprous oxide
30 to 60 parts by weight manganous oxide.

All the components are used in a finely ground condition. To improve adhesion and hence reduce dust, 2 to 4 parts by weight of spindle oil are worked into the composition, while for identification 0.05 to 1 part by weight of a dye may also be incorporated. Seed is treated dry with this composition.

B. *Combination with the same micro-nutrients and fungicides*

Into the mixture of Example 5A above are worked in addition:—

1 to 10 parts by weight of organic mercury compound, namely methoxyethyl-mercury benzoate and/or 5 to 20 parts by weight of hexachlorophenol or pentachloronitrobenzene.

If it is desired simultaneously to control insects, for example wire worms, insecticides such as hexachloro*cyclo*hexane, aldrin and dieldrin, may be added to an extent of 20—40% by weight of the seed-treating composition. Corresponding reductions in the amount of manganous oxide should preferably be made when adding these insecticides.

EXAMPLE 6

Compositions containing macro-nutrients

A. 0.2 to 0.5% of 4,5-dimethyl-imidazolone-2 are added to superphosphate fertilizer.

B. 1.2 parts by weight of 4,5-dimethyl-imidazolone-2 are worked into the mixture of Example 2, and the composite fertilizer so obtained applied in the solid state.

C. The dry composition of Example 2 is first made up without a urea derivative, and then the 5-chloro-benzimidazolone is dusted onto the composition in a slightly damp, granulated form. For this the urea derivative is mixed before dusting with dry talc.

D. The composition described in Example 2 is worked into a paste, or formed into kernels, balls, rods or other suitably-shaped bodies for fertilizing, using a suitable binding-agent, such as a solution of a glue.

EXAMPLE 7

Compositions with inert solid carriers

2 to 5 mg of N,N'-dimethyurea are mixed into each litre of a mixture of earth and sand, and this composition applied in any convenient manner.

A number of experiments were also conducted in order to illustrate the growth-promoting action of the urea derivatives of the compositions according to the invention. The results of these experiments are presented in tabular form, each table representing experiments conducted on a particular species of plant.

The growth-promoting action of the urea derivatives used according to the invention is first shown by the cress root test carried out by the plate method of Flaig and Otto (Landwirtschaftliche Forschung, Vol. 3, page 66 (1951/52)). To a $\frac{1}{10}$ Knop nutrient solution (cp. e.g. Schropp, die Methodik der Wasserkultur hoherer Pflanzen, page 132, Neumann-Verlag 1951) is added 2.5 mg of urea derivative per litre, and the length of the roots is measured after 6 days.

TABLE 1

Demonstration of activity by the cress root test

Amount of urea derivative : 2.5 mg. per litre of $\frac{1}{10}$ Knop nutrient solution

Measurement after 6 days

Exp. No.	*Urea derivative*	*Average length of root in millimetres* absolute	relative	*Number of individual measurements*
1	Control without urea derivative ...	146	100	98
2	N,N'-di-*tert*-butyl urea	162	111	108
3	imidazolone-2	168	115	102
4	4,5-di-[furyl]imidazolone-2	162	111	101
5	benzimidazolone-2	164	112	95

As is shown in the table, the growth of the cress roots is increased by 11—15% by the addition of the urea derivative. For greater accuracy, a large number of individual measurements were carried out each time.

In a further series of experiments, growth-promoting urea derivatives were incorporated in a seed-treating composition, which consisted of the micro-nutrients copper, boron and manganese in a sparingly soluble form and absorbable by the plant, but otherwise contained no further additives. Yellow oats served as test plants; the experiments were carried out in Mitscherlich vessels, and the results evaluated in the usual form.

The amount of urea derivative used was 18 parts by weight to 100 parts by weight of seed-treating agent, corresponding to 1.5 mg. of urea derivative per vessel.

TABLE 2

Vessel experiment with yellow oats

Seed treatment with sparingly soluble micro-nutrients and urea derivative corresponding to 1.5 mg. per vessel

Exp. No.	Urea derivative	Yields: Total g. M±	m	rel	Grain g. M±	m	rel	Straw g. M±	m	rel
6	Control without urea derivative	49.2	0.95	98	21.2	0.01	100	28.0	0.98	96
9	Control with added Hg*	50.4	0.72	100	21.1	0.24	100	29.3	0.48	100
7	4,5-d-[furyl] imidazolone-2	55.4	0.87	110	24.2	0.97	115	31.2	1.20	107
8	N,N'-di-*tert*-butyl-urea	56.2	0.66	111	24.3	0.20	115	31.9	1.50	109

M is the mean value of the results obtained from a series of experiments. *m* is the deviation of individual results in the series of experiments from the mean value of the results. *rel* is the relative value of the mean value of a series of experiments with regard to the mean value of the control taking the control as 100.

*So as to facilitate a comparison with the next series of experiments, experiments 9 from table 3 has been included here.

The next series of experiments was carried out with a seed-treating agent which contained the same sparingly soluble, absorbable mixture of micro-nutrients (Cu, Mn, B) and in addition 2% of organically combined mercury; the urea derivatives of compositions according to the invention are worked into this composition, and the seeds are treated dry. The experiments were carried out in Mitscherlich vessels with the same test plant (yellow oats) as in Table 2. The amount of urea derivative used was varied as follows:—

Experiment No. 10: 6 parts by weight of urea derivative to 100 parts by weight of seed-treating composition=0.5 mg. of urea derivative per vessel

Experiment No. 11: 18 parts by weight of urea derivative to 100 parts by weight of seed-treating composition=1.5 mg. of urea derivative per vessel

Experiment No. 12: 6 parts by weight of urea derivative to 100 parts by weight of seed-treating composition =0.5 mg. of urea derivative per vessel.

TABLE 3

Vessel tests with yellow oats

Seed treatment with sparingly soluble, absorbable micro-nutrients, 2% organically combined mercury and urea derivatives.

Exp. No.	Urea derivative	Yields: Total M±	m	rel	Grain M±	m	rel	Straw M±	m	rel
9	Control without urea derivative	50.4	0.72	100	21.1	0.24	100	29.3	0.48	100
10	benzimidazolone-2	56.0	0.49	111	23.5	0.46	111	32.1	0.75	110
11	benzimidazolone-2	57.4	0.67	114	24.0	0.69	114	33.4	0.22	114
12	N,N'-di-*tert*-butyl-urea ...	56.3	1.7	112	23.3	0.30	110	33.0	1.45	113

The growth-promoting action of the urea derivatives in the above table appears to be uniform for both grain and straw relative to the control sample.

These urea derivatives had a similar action in experiments with green peas likewise carried out in Mitscherlich vessels. The seed was treated with the mixture of sparingly soluble micro-nutrients, 2% of organically combined mercury and urea derivatives.

Amount of urea derivative in all experiments (control excepted):—

6 parts by weight to 100 parts by weight of seed-treating composition =0.5 mg. of urea derivative per vessel.

TABLE 4

Vessel tests with green peas

Seed treatment with sparingly soluble micro-nutrients, 2% of organically combined mercury and 0.5 mg. of urea derivative per vessel.

Exp. No.	Urea derivative	Yields fresh weight M	± m	rel	dry weight M	± m	rel
13	Control without urea derivative	127.9	3.8	100	21.8	0.76	100
14	benzimidazolone-2	150.6	2.34	118	26.1	0.30	120
15	4,5-di-[furyl]-imidazolone-2 ...	148.9	0.97	116	25.2	0.54	116
16	N,N'-di-*tert*-butyl-urea ...	152.3	2.32	119	25.8	0.64	118

The effectiveness of the urea derivatives in compositions according to the invention can clearly be seen.

Green maize (country maize from Baden) served as test plant in the next series. The seed was treated dry as in the previous experiments with a mixture of sparingly soluble micro-nutrients, 2% of organically combined mercury and urea derivatives and then placed in Mitscherlich vessels.

In one case (experiment 18), dry unsubstituted urea itself was worked into the seed-treating composition in such a quantity that the composition contained 5.7% of nitrogen. This corresponds approximately to the quantity of nitrogen contained in the compositions containing urea derivatives according to the invention.

TABLE 5

Vessel tests with green maize

Seed treatment with sparingly soluble micro-nutrients, 2% of organically combined mercury and urea derivatives. In experiment 18, the added urea corresponds to 5.7% N. In experiment 23, the urea derivative was applied by leaf-spraying.

Exp. No.	Urea derivative	addition by	Amount	Yield/dry substance M±	m	rel
17	Control without urea derivative	—	—	88.6	1.55	103
18	Control+urea	—	—	85.7	1.55	100
19	N-*tert*-butyl-urea	seed-treating composition	1.0 mg/vessel	104.8	2.16	122
20	N,N'-di-*tert*-butyl-urea	"	0.5 "	92.4	1.64	108
21	benzimidazolone-2	"	0.5 "	106.6	2.56	124
22	benzimidazolone-2	"	1.0 "	97.5	2.85	114
23	N-*tert*- and N,N'-di-*tert*-butyl-urea 1 : 1 in 0.0025% aqueous solution	leaf-spraying	2 x 10 ml of the solution	96.7	3.62	113

The results of this table are informative in several respects. Experiment 18 shows the action of unsubstituted urea acting as a source of nitrogen. Comparison with experiments 19 to 23 shows that the activity of the urea derivatives used in accordance with the invention is substantially greater and exceeds the effect of simple nitrogen addition. This was unexpected, since the nitrogen is more firmly bound in the urea derivatives, so that a slower absorption by the plant would be expected to occur. Putting the value for urea at 100 as has been done here, then the urea derivatives used according to the invention caused an increase of yield of up to 24%.

Experiment 23 shows on the one hand that more than one urea derivative can be used at once, and on the other hand that application by means of leaf-spraying, using highly dilute solutions is both possible and effective.

The following tables contain experimental results for broad beans (*Vicia faba*) in Mitscherlich vessels:—

Table 6, experiments 24 to 30: addition of urea derivative by seed-treating composition as described above.

Table 7, experiments 31 to 37: addition of urea derivative by leaf-spraying with highly dilute solutions.

Table 8, experiments 38 to 42: addition of urea derivative by mixing into the soil, similar to the so-called crumb fertilisation.

TABLE 6

Vessel tests with broad beans

Seed treatment with sparingly soluble micro-nutrients, 2% of organically combined mercury and urea derivatives.

Exp. No.	Urea derivative	Application mg. per vessel	Yields/dry substance M±	m	rel
24	Control without urea derivative	—	23.1	1.20	100
25	Control+urea	—	23.6	1.13	102
26	N-*tert*-butyl-urea	0.8	25.5	1.03	110
27	N-*tert*-butyl-urea	1.6	27.2	0.32	118
28	N,N'-di-*tert*-butyl-urea	1.6	26.6	0.41	115
29	imidazolone-2	1.6	26.2	0.88	114
30	imidazolone-2	2.4	27.8	1.02	120

The control experiment with urea (No. 25) here also confirms its low activity compared with the urea derivatives used according to the invention.

TABLE 7

Vessel tests with Broad beans

Seed treatment with sparingly soluble micro-nutrients 2% of organically combined mercury. Addition of active composition by leaf-spraying with 0.0025% solutions.

Exp. No.	Urea derivative	Application ml. per vessel	Yields/dry substance M±	m	rel
31	Control without urea derivative	—	23.1	1.2	100
32	N-*tert*-butyl-urea	2 x 10	25.9	0.49	112
33	N,N'-di-*tert*-butyl urea	2 x 10	25.5	0.64	110
34	N-*tert*- and N,N'-di-*tert*-butyl urea (1 : 1)	2 x 10	25.7	0.35	111
35	imidazolone-2	2 x 10	27.1	0.91	117
36	imidazolone-2 and benzimidazolone-2 in a ratio of 1 : 1	2 x 10	27.8	0.32	120
37	N-*tert*- and N,N'-di-*tert*-butyl urea, imidazolone-2 and benzimidazolone-2 (1 : 1 : 1 : 1)	2 x 10	27.9	1.14	121

The results achieved by means of leaf-spraying of the highly dilute solutions (0.0025%) are of the same order of magnitude as those obtained by means of seed treatment. Thus this recently developed method of applying macro- and micro-nutrients and insecticides can also be used for the application of compositions according to the invention. The solutions of the active substances can be applied in one or more sprayings, and wetting agents and the like may also be incorporated in the solutions. Fine distribution also increases activity of the urea derivatives.

For applying the urea derivatives by means of so-called crumb fertilisation, 10 mg. of urea derivative were thoroughly mixed with the total quantity of soil in individual Mitscherlich vessels (6 kg). The soils received in addition a uniform fertilisation with the macro-nutrients superphosphate, potash and nitrogen. Since the fertilisation of the soil was carried out uniformly in all experiments of this series, it can be ignored when assessing the results.

TABLE 8

Vessel tests with broad beans

Seed treatment with sparingly soluble micro-nutrients, 2% of organically combined mercury, and 10 mg. of urea derivative worked into 6 kg. of soil. Uniform ground-fertilisation with phosphorus, potash and nitrogen.

Exp. No.	Urea derivatives	Yields/dry substances M±	m	rel
38	Control without urea derivative	23.1	1.20	100
39	N-*tert*-butyl-urea	25.7	1.13	111
40	N,N'-di-*tert*-butyl-urea	26.8	0.73	116
41	imidazolone-2	26.0	0.51	113
42	benzimidazolone-2	26.0	1.20	113

Further experiments were carried out with a typical leaf plant, namely with spinach (sharp-seed winter). Here a simple increase of growth may be equated with an increase of yield.

The experiments were carried out in seedling boxes under open country conditions. The seed was treated with the above-mentioned micro-nutrient mercury seed-treating composition into which the urea derivatives had been worked, and sowed each time in 4 rows, at a rate of one gram of seed per linear metre.

TABLE 9

Box experiments with spinach

Open country conditions, seed treatment with sparingly soluble micro-nutrients, 2% of organically combined mercury and urea derivatives.

Exp. No.	Urea derivative	Application parts by weight of urea derivative per 100 parts of seed-treating composition	Yields: fresh weight grams	fresh weight rel	dry weight grams	dry weight rel
43	Control without urea derivative	—	336.5	100	31.7	100
44	N-*tert*-butyl-urea	12	497·7	142	47.3	149
45	N,N'-di-*tert*-butyl-urea	12	428.1	127	38.0	120
46	imidazolone-2	12	426.8	127	39.9	126
47	benzimidazolone-2	6	448.6	133	43.4	137
48	benzimidazolone-2	12	513.6	152	48.2	152

The growth or yield increase is here particularly significant. Thus in one case it amounts to more than 50%, otherwise from 27 to 42%.

In a further series of experiments seeds of forest trees were treated dry with a mixture of sparingly soluble but resorbable micro-nutrients and urea derivatives, such as are described in Tables 3 to 8.

The growth-promoting influence of the active substances according to the invention on the seed of *Quercus rubra* and *Fagus silvatica* first became apparent in that compared with the untreated controls, a substantially larger number of fruit germinated, whereupon also the young plants showed a stronger development; subsequently a stronger development and widening of the leaves took place.

In another series of experiments year-old seedlings of forest pine (*Pinus silvestris*) were dipped into 0.002 to 0.02% aqueous solutions of the active urea derivatives for 5 to 10 minutes and planted immediately thereafter.

Compared with the untreated controls the number of seedlings which took root was first substantially higher, and very soon the treated plants showed an increased needle formation and a stronger growth in length. Their development was in general also stronger.

As is shown in the following series of experiments the urea derivatives used according to the invention are suitable not only for promoting the growth of useful plants, but also of ornamental plants.

N-tertiary butyl urea was dissolved in a mixture of ethanol and water (1 : 1) with the addition of a small quantity of a commercially available dispersing agent (an ethylene oxide condensation product) to yield a 5% solution, and this solution was then diluted with water in the ratio of 1 : 500.

Then 20 cc of this dilute solution were used for pouring on seedlings of the Alpine violet (*Cyclamen persicum*) which were grown in pots in a layer of peat; each pot containing 500g. of peat. Test plants and untreated controls were treated with a well-balanced ground-fertilizer (2 g. per litre of peat) containing phosphorus, potash and nitrogen, as in Table 8, small quantities of the micro-nutrients Mn, Cu, B in the form of water-soluble salts, and in addition 3 g of calcium carbonate. The figures of the table are mean values for 5 plants each time.

TABLE 10

Pot test with seedlings of *Cyclamen persicum*

Exp. No.	Urea derivative	Widths of leaves in cm after 6 weeks	Widths of leaves in cm after 20 weeks	Number of* leaves after 20 weeks	Flowers and buds after 22 weeks	
49	Control without urea derivative	6	7.8	31	1	1
50	2 x 2 mg of N-*tert*-butyl-urea	10	12	40	8	3
51	2 x 4 mg of N-*tert*-butyl-urea	10	12	44	7	1

*fully grown leaves

WHAT WE CLAIM IS:—

1. Agricultural or horticultural compositions possessing plant-growth regulating properties and comprising as an active ingredient one or more mono-alkyl or di-alkyl substituted ureas or cyclic-substituted ureas (as herein defined) together with a suitable carrier as herein defined.

2. Compositions as claimed in claim 1, in which the suitable carrier is a liquid and comprises in addition one or more of the following agents: dispersing, emulsifying, suspending, wetting, nutritional, plant-growth stimulating, fungicidal, bactericidal, insecticidal, acaricidal and/or soil-improving agents.

3. Compositions as claimed in claim 1 in which the suitable carrier includes solid form in which the suitable carrier includes one or more of the following: inert, solid diluents and nutritional, plant-growth stimulating, fungicidal, bactericidal, insecticidal, acaricidal, soil-improving and/or binding agents, fillers and humus substances.

4. Compositions as claimed in any of the preceding claims in which the alkyl-substituted ureas are substituted with alkyl groups containing 1 to 4 carbon atoms.

5. Compositions as claimed in claim 4, in which the alkyl-substituted ureas are N-*tert*-butyl-urea, N,N'-di-*tert*-butyl-urea and N,N'-dimethylurea.

6. Compositions as claimed in any of claims 1 to 3, in which the cyclic-substituted ureas are imidazolone-2, alkyl-, aryl- and furyl-substituted imidazolone-2, benzimidazolone-2, and halogen-, alkyl-, amino-, alkoxy- or acyl-substituted derivatives thereof.

7. Compositions as claimed in claim 6, in which the cyclic-substituted ureas are

4,5-di-[furyl]-imidazolone-2,
4,5-diphenyl-imidazolone-2,
4,5-dimethyl-imidazolone-2,
5-chloro-benzimidazolone-2,
5-methoxy-benzimidazolone-2,
5-acetyl-benzimidazolone-2,
5-myristyl-benzimidazolone-2,
5-butyryl-benzimidazolone-2,
4,5,6-trimethyl-benzimidazolone-2.

8. Agricultural and horticultural compositions as claimed in claim 1 substantially as herein described with reference to the Examples.

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